

OTT Times

TRACKING THE ADVANCEMENT OF TRANSPORTATION TECHNOLOGY

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On The Move

Dear Reader:

Happy New Year and welcome to 1997's first issue of *OTT Times*. This new year brings us expectations of a new leadership for the Department, some "new" technologies, and a renewed effort to focus our work towards reducing the use of foreign oil by optimizing America's energy use in the transportation section.

In this issue we discuss two of our technologies that will help to get us there. The first is a new way of parts for vehicles, using aluminum instead of cast iron. A lighter weight vehicle gets a long way towards reducing fuel use, thus cutting back on our dependence on other countries for our oil.

The second technology is the on-board fuel processor for use in fuel cell vehicles. This processor can reform any type of carbon fuel to hydrogen, producing a vehicle with near-zero emission levels. Even if the fuel used is gasoline, the fuel-cell powered vehicle will be twice as efficient as the conventional internal combustion engine.

Over the next few months, we will be bringing you many more stories like these, which demonstrate our commitment to provide this country with safe, economical, and environmentally beneficial transportation fuels.

This year also brings us a new Secretary of Energy, and we welcome our new leader, Federico Peña. While it is too early at press time to know of Secretary Peña's goals for DOE and OTT, the fact that he has a highly respected history of experience in transportation issues leads us to anticipate an especially strong and supportive working relationship.

We think the Secretary will like "his" first issue of *OTT Times*—it features news

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OTT partnership meets GM's "impossible" development deadline

General Motors (GM) has ordered a total of 1.15 million lightweight aluminum automotive motor mounts manufactured using a new, cost-effective process developed and optimized by Thompson Aluminum Casting Inc. (TAC) and OTT. GM will include the major structural part in its regular production Cadillac STS 5 vehicles.



Aluminum motor mounts made by new metal compression forming process

The aluminum motor mounts are half the weight of their traditional cast-iron counterparts, giving the car manufacturer an additional ability to produce lighter, and therefore, more fuel-efficient vehicles. In addition, the new parts cost 40 percent less to produce than forged aluminum and are more consistent than cast aluminum, and so represent a major improvement over these two most common methods of aluminum parts manufacturing.

The breakthrough is TAC's innovative metal compression forming process, developed independently by Thompson

and optimized through a Cooperative Research and Development Agreement (CRADA) with OTT and the DOE Oak Ridge National Laboratory (ORNL). A few months after the CRADA was formed in mid-1995, GM learned of and was intrigued by the potential of the technology in its early stages, and issued the partners a challenge: deliver optimized

parts by April 1, 1996 and they would be tested for possible inclusion in 1998 model vehicles. The four-month time frame, nearly unprecedented in an industry where the development cycle is usually closer to four years, accelerated the CRADA team's efforts, and led OTT program manager Sid Diamond to dub the challenge a "Mini Manhattan Project."

According to TAC Vice President Bob Purgert, ORNL's

massively parallel computer modeling capability, and the expertise to utilize it effectively, made the difference for the CRADA team, allowing them to run

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OTT Partnership

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variable calculations in just a few hours, or even minutes. On a traditional mainframe, it would have taken hundreds of hours. As a result, the team optimized the process and delivered high-quality test parts on time. GM was so impressed with the parts' performance that they entered commercial orders for 400,000 parts in 1997 with the option to increase production to 750,000 parts annually.

OTT's Sid Diamond notes that the TAC/OTT process, quickly proven and commercialized, holds even greater future promise for reducing vehicle weight, improving fuel economy and reducing America's dependence on foreign oil. The technology is evolving and expanding to allow even further weight reductions on additional key automotive parts, utilizing not only aluminum, but also metal matrix composites and magnesium, the latter offering up to an additional 40 percent weight reduction at equal strength.

Clean Cities Designations

1. Atlanta, GA	09/08/93	34. Peoria, IL	11/22/94
2. Denver, CO	09/13/93	35. SW Kansas	03/30/95
3. Philadelphia, PA	09/22/93	36. Central New York	06/15/95
4. Wilmington, DE	10/12/93	37. Dallas-Fort Worth, TX	07/25/95
5. Las Vegas, NV	10/18/93	38. Honolulu, HI	08/29/95
6. Washington, D.C.	10/21/93	39. Missoula, MT	09/21/95
7. Boston, MA	03/18/94	40. New Haven, CT	10/05/95
8. Austin, TX	04/18/94	41. Central Arkansas	10/25/95
9. Florida Gold Coast	05/05/94	42. Paso del Norte, TX	11/17/95
10. Chicago, IL	05/13/94	43. Pittsburgh, PA	12/05/95
11. Albuquerque, NM	06/01/94	44. SCAG	03/01/96
12. Wisconsin SE Area	06/29/94	45. Los Angeles, CA	03/22/96
13. Colorado Springs, CO	07/13/94	46. Coachella Valley, CA	04/22/96
14. Long Beach, CA	08/31/94	47. Weld/Larimer/RMNP	05/21/96
15. Lancaster, PA	09/22/94	48. Central Oklahoma	05/29/96
16. Salt Lake City, UT	10/03/94	49. Hampton Roads, VA	10/04/96
17. White Plains, NY	10/04/94	50. San Diego, CA	12/12/96
18. Baltimore, MD	10/07/94	51. Long Island, NY	10/18/96
19. Louisville, KY	10/18/94	52. Detroit, MI -	
20. Rogue Valley, OR	10/18/94	Toronto, ONT	12/18/96
21. West Virginia	10/18/94	53. Tri-State	
22. Sacramento, CA	10/21/94	(Greater Cincinnati)	01/29/97
23. Oakland, CA	10/21/94	54. Evansville, IN	01/30/97
24. San Joaquin Valley, CA	10/21/94	55. Red River Valley	TBA-
25. San Francisco, CA	10/21/94	(Grand Forks, ND)	Spring '97
26. South Bay (San Jose)	10/21/94		
27. Western New York	11/04/94		
28. Portland, OR	11/10/94		
29. St. Louis, MO	11/18/94		
30. Norwalk, CT	11/21/94		
31. Waterbury, CT	11/21/94		
32. Norwich, CT	11/22/94		
33. New London, CT	11/22/94		

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On The Move

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about two OTT programs that are making a significant impact in our country's transportation sector, and have even made some headlines in industrial and consumer publications. We are proud of this recognition, and even prouder of the fact that they are helping us advance our goal to improve America's energy security. Read about them and let us know your thoughts.

Until next time—

Ann Hegnauer

Mark your calendar for
the 3rd National Clean
Cities Stakeholders
Conference and Exposition,
June 24-26, 1997 at
the Sheraton Long
Beach, Long Beach, CA.
For more information,
call Linda Bluestein at
800-224-8437

Clean Cities

Patrick Davis likes OTT's Customer Focus



Patrick Davis

Fuel Cell and compression-ignition direct-injection (CIDI) engine program manager Patrick Davis has been working on energy storage and conversion systems for nearly 15 years, starting his career in another area of government, the U.S. Navy, and with a “cousin” of fuel cell technology—the advanced battery.

“I was a civilian engineer, developing and testing batteries for underwater

vehicles and sonobuoys, which locate and track submarines,” he said. “Colleagues would design a device and then come to me to develop a power source that would fit the space left over, as well as meet the needs for power, energy, voltage and shelf life. It was like solving a puzzle.”

Pat’s efforts included work with thermal batteries, which remain dormant until heated with an internal pyrotechnic heat source. These batteries are valuable because they have a very high-power density and can be warehoused without self discharge. He was instrumental in introducing thermal batteries for sonobuoys, spearheading the next generation of the device.

His success with battery development and testing led OTT to hire him to work on the U.S. Advanced Battery Consortium (USABC) program, managing testing for many of the deliverables coming out of that dynamic effort. He chaired the USABC’s Battery Test Procedures

Committee, and helped revise and update their widely used testing manual.

That responsibility segued into his current focus, managing the GM Proton Exchange Membrane (PEM) fuel cell program and the fuel-flexible fuel processor program with A.D. Little, the latter recently becoming very visible due to Chrysler’s announcement that it hopes to develop a vehicle with the technology. Most recently, he has taken on the responsibility of the CIDI engine program.

Pat notes that programs like these require an approach very different from his work in the Department of Defense. “In the Navy, we were our own customer and we designed systems to a fairly narrow set of specifications, often in very low production volumes. If it was more expensive or not very elegant, it didn’t really matter, as long as it worked better and more efficiently than what came before,” he explained. “At OTT, our customers are external and much more

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Customer Q&A

OTT Times talks with Jeff Bentley, Director of Transportation Technology, Arthur D. Little

In 1992, Arthur D. Little (ADL) teamed with OTT in an ongoing cost-shared partnership program to advance the development of on-board fuel processors. The project involved developing a prototype model of the first-ever transportation-specific multifuel reformer capable of converting gasoline, ethanol and other carbon sources to hydrogen. In transportation applications, this breakthrough technology allows the on-board production of the hydrogen needed by fuel cells to generate electricity, which powers the vehicle. According to ADL, hybrid vehicles powered by gasoline and fuel cells will be twice as efficient as convention internal combustion engines while approaching near-zero emission levels, helping reduce fuel costs to consumers, decrease U.S. reliance on imported energy sources, and promote a cleaner environment. Recently, Chrysler announced its plans to utilize ADL’s proprietary reformer technology to create a prototype fuel-cell powered vehicle within two years. Here’s what ADL’s Jeff Bentley had to say about the project.

Q: What was the genesis of this exciting program?

A: “ADL has a long history of developing technologies for the automotive and transportation industry. Recently, for example, we licensed for production to GM and Chrysler an advanced air conditioning compressor we designed and prototyped. We became interested in the potential of fuel cells in the early ’90s as a result of work done with our power generation clients in the utility industry. We were investigating the use of fuel cells in vehicles but, like OTT and the auto industry at that time, we saw that there was a very high infrastructure hurdle to deal with—after all, drivers can’t go down to the corner and buy hydrogen. OTT issued a request for proposal (RFP) for developing a fuel-flexible reformer that would enable the on-board production of hydrogen from a number of more common fuels, and we were awarded the cost-shared contract.”

Q: What fuels were to be utilized?

A: “The project was originally envisioned as reforming only alternative fuels, but evolved over the years as the realization was made that if the reformer didn’t provide the option to convert gasoline, with its widely available fueling infrastructure, fuel cell vehicles would not become a shorter term solution. As you can imagine, using gasoline was a controversial decision, and OTT deserves a lot of credit for taking a practical approach—they’ve probably shaved 5-10 years off of the time frame for a real-world fuel-cell vehicle to be produced. Of course, since fuel cells can take a vehicle two to three times further on a gallon of gas, and produce nearly zero emissions, even using gasoline allows OTT to forward their goals of reducing the use of foreign oil and reducing air pollution. And, in the longer term, the fuel flexibility of the reformer will allow the use of

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OTT Customer Focus

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demanding. New transportation technologies not only have to be better, but they have to be attractive to the user in every way, including being convenient and cost-effective. It's an exciting, expanded point of view. And, that big-picture focus is even greater for fuel cell work than batteries; they tend to be even more systems-oriented."

In his spare time, Pat plays trombone in a local variety band he's been a member of for more than 20 years. He and his wife have a six-year-old daughter, and although she's too young to understand the scope of Pat's work, she proudly points out to her friends the DOE logo displayed during the credits of the *Magic School Bus*, the children's science show that the Department cosponsors on PBS.

"I have no doubt that by the time my daughter is driving, alternative-fuel vehicles will be commonplace—and OTT and its partners will be responsible for

that," he said. "I believe that gasoline supply and price issues will ultimately lead consumers to more aggressively seek out more efficient alternatives. And we've been working on that all along—in technologies for vehicles designed with the customer in mind."

Customer Q&A with A.D. Little

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domestically sourced fuels, especially ethanol, as the growing infrastructure for these alternative fuels expands even further."

Q: What is the role of Chrysler and other partners?

A: "A number of organizations have been involved in this project, including Chrysler and ethanol advocacy groups such as the state of Illinois, which provided funding in ethanol-related aspects of the technology. Chrysler joined the partnership about a year ago as a subcontractor providing guidance on applying the technology to a vehicle, and, of course, is now picking up the ball and running with it, taking the technology, hopefully, to its ultimate commercial vehicle phase. They presented a model of a proof-of-concept car at an auto show earlier in the year, and announced plans to unveil a working vehicle using the OTT/ADL technology in 1999."

Q: When will the technology be commercialized?

A: "The shortest-term commercial applications of the reformer technology will likely be in non-transportation-related areas such as stationary power applications and any number of industrial applications which use hydrogen. Instead of shipping in large quantities of hydrogen, users can produce it cost-effectively on-site using an available fuel such as natural gas. These niche markets could be served within a year, creating the early stages of a fuel reformer industry which will forward the transportation applications as well."

Q: How has ADL benefitted from its partnership with OTT?

A: "... Being involved in such a flagship OTT program has provided an outstanding

return. Besides any ultimate revenues, the effort has also enhanced ADL's reputation for the kind of innovation that enables a practical business result, and highlights our abilities to take tough technical problems and solve them creatively."

"But none of this would have been possible without the commitment of OTT; the vision we shared in the early '90s was not conventional wisdom at the time, and the idea of putting a reformer in a car was actually ridiculed by many in the scientific community. But OTT really championed the idea, and, with the establishment of the Partnership for a New Generation Vehicles (PNGV) with its goal of producing an 80-mpg vehicle, the concept really gained an impetus. This effort and others like it have really focused the attention of automakers on the value of fuel cells, and it looks like we are very close to making highly efficient, near-zero emissions fuel cell vehicles a reality. It's exciting to see work that we've been so involved with for more than six years finally getting some wider recognition and support."

COMING EVENTS

MARCH 21-23, 1997
7TH ANNUAL ECO EXPO WEST
Los Angeles, CA
Contact Barbara Short at
800-334-3976

APRIL 7-10, 1997
5TH ANNUAL ENVIRONMENTAL VEHICLES '97
Westin Hotel, Detroit, MI
Contact Renee Fox at
810-355-2910

MAY 5-8, 1997
SAE FUELS & LUBRICANTS MEETING
Dearborn, MI
Contact SAE at
412-776-4841

MAY 17-24, 1997
9TH ANNUAL NESEA AMERICAN TOUR DE SOL
Waterbury, CT to Portland, ME
Contact NESEA at
413-774-6051

